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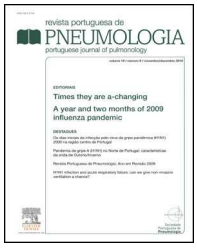

ORIGINAL ARTICLE

The overall impact of COPD (CAT) and BODE index on COPD male patients: correlation?

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KEYWORDS
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Abstract
Background: Chronic Obstructive Pulmonary Disease (COPD) will be the 5th leading cause of disability (DALYs) and the 4th leading cause of death by 2030. Measuring the real impact of COPD using CAT (''COPD Assessment Test'') can complement BODE index, an indicator of mortality.
Aims: To assess correlation between CAT and BODE index in COPD patients.
Materials and methods: A retrospective study was conducted in a population of patients with COPD in a Respiratory Rehabilitation program. We analyzed demographic variables, variables in respiratory function – 6 min walking test (6MWT), post-BD forced expiratory volume in 1st second (FEV1%); dyspnea by mMRC scale; BODE Index and CAT.
Results: The study included 50 patients – GOLD stage I (7), II (25), III (14) and IV (4), 48 men; mean age 62.6 years (±9.5), average BMI 25.8 kg/m^2 (±4.8) and FEV1 57.1% (±19.6); 6MWT of 443.3 m (±61.6); 46% patients in classes 2 and 3 of mMRC scale; 84% were class 2 in BODE Index. About 80% reported slight to medium impact in CAT. CAT score and impact were correlated with BODE index score: $R = 0.475$, $p < 0.01$, and $R = 0.377$, $p = 0.004$, and BODE index class: $R = 0.357$, $p = 0.011$, and $R = 0.326$, $p = 0.021$.

Abbreviations: BMI, body mass index; BODE, body mass index, airflow limitation (forced expiratory volume in one second), dyspnoea and 6-min walk distance; FEV1, forced expiratory volume in one second; CAT, COPD assessment Test; CCQ, Clinical COPD questionnnaire; COPD, chronic obstructive pulmonary disease; FEV1%predicted, forced expiratory volume in one second in percent of the predicted value; mMRC, Modified Medical Research Council dyspnoea scale; GOLD, global initiative for chronic obstructive lung disease; SGRQ, St. George's Respiratory Questionnaire; 6MWT, 6-min walking test.

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Conclusion: As pre-existent data in the literature (exacerbations and benefit of rehabilitation in COPD), the positive correlations found with BODE index reinforce the discriminative validity of CAT as a complement in the evaluation of what the true impact of COPD is on a patient's daily life.

Background

Chronic Obstructive Pulmonary Disease (COPD) is a common disease[1] (in Lisbon BOLD survey the estimated prevalence of COPD was 14.2%[2]) and the World Health Organization (WHO) estimates that it will be the fifth leading cause of disability (DALYs) and the fourth leading cause of death by the end of 2030.[1]

COPD patients often develop symptoms such as dyspnea, cough, chest tightness, exercise intolerance, sleep and mental disorders and social activity restriction, but COPD management and treatment have been largely based on spirometric assessment.[3] Recently, GOLD guidelines proposed dyspnea measurement, health status/quality of life impairment, and number of exacerbations as key elements (in addition to spirometry) with which to manage and treat COPD,[4] allowing health status and quality of life impairment to become part of overall COPD patients' management and a major concern for physicians. Several health status questionnaires and/or quality of life tools, such as St. George's Respiratory Questionnaire (SGRQ),[5] Chronic Respiratory Questionnaire (CRQ),[6] Clinical COPD Questionnaire (CCQ),[7] and COPD Assessment Test (CAT),[8] have been developed due to this growing awareness of the importance of health status, in an attempt to find a reliable tool to use in clinical practice.[9] CAT is the most recently developed questionnaire for COPD (2009); it is simple, validated, and self-completed and should be given to all COPD patients, irrespective of disease severity. Although no study has been carried out as to how applicable this is to the Portuguese population, CAT has been validated for use in the Portuguese language and its applicability has been tested in several countries, including Spain[10] and Brazil,[11] where it was considered a reliable instrument for evaluating patients with COPD. A recent study performed in 2011[12] proved that there was substantial agreement between CAT and SGRQ since CAT correlates very well with the SGRQ-C in stable COPD patients and during exacerbations.

The BODE index (body mass index, airflow obstruction, dyspnea, and exercise capacity) is a multidimensional grading system for COPD that includes symptoms assessment, nutritional state, exercise capacity and spirometric measure of airflow (FEV1 post-bronchodilator).[13] BODE reflects the progressive modification in the disease[14] and it is useful for predicting hospitalization and the risk of death among patients with COPD,[15] in the follow-up of lung functional change during pulmonary rehabilitation,[16] in predicting patient's survival after receiving lung volume reduction surgery[17] and the worsening of health-related quality of life in COPD patients as measured by SGRQ[18–20] and the total Clinical COPD Questionnaire CCQ score (specially the functional status) which corroborates the link between BODE index and quality of life.[21]

Since CAT is a recently developed questionnaire, little is known about its correlation with BODE index in terms of measurement of quality of life. This study aimed to understand if there is a relationship between the CAT questionnaire and the BODE index in order to enhance the understanding of COPD in its global disease spectrum and consequences. Measuring COPD using CAT (''COPD Assessment Test'') may complement the BODE index as an indicator of morbidity and mortality.

Materials and methods

Subjects

This was a retrospective study using existing data of stable COPD patients, with optimized therapy (correct inhalation techniques after repeated teaching) in a Respiratory Rehabilitation program at the Pulmonology Department in Centro Hospitalar de Vila Nova de Gaia, Portugal, between January 2010 and October 2011. Fifty patients had been included after excluding those with concomitant asthma or any respiratory disease other than COPD. The study was approved by the Ethics Committee of the hospital.

Data collection

Demographic information and medical records were reviewed (data collection was approved by the head of department and patient confidentiality was maintained). Baseline spirometry and carbon monoxide diffusion (DLCO) were performed before the beginning of the rehabilitation program respecting the ATS/ERS recommendations[22] and using a standard Pulmonary Function Tests (PFT) unit. Blood gases were determined in arterialized samples. COPD diagnosis was based on examination by a chest physician including spirometry test after bronchodilator use with FEV1/FVC ratio lower than 0.70, and GOLD guidelines reviewed in 2010[4] were used to classify disease severity since the latest GOLD guidelines[3] were not available at the time this study was performed.

Table 1 Baseline characteristics of patients' sample.

Variable	Mean	SD
Age (years)	62.5	9.5
Body mass Index	25.8	4.8
FEV 1 (L)	1.5	0.5
FEV 1 (%)	57.1	19.6
FVC (L)	2.8	0.6
FVC (%)	80.1	19.3
FEV1/FVC	53.2	0.1
DLCO (%)	59.8	19.9
PaO_2 (mmHg)	73.1	9.4
$PaCO_2$ (mmHg)	39.7	5.0
mMRC	1.9	1.1
6MWT (m)	443.3	61.6

Body mass index (BMI), the modified Medical Research Council dyspnoea scale (MMRC),[23] the 6-min walking test (6MWT) and pulse oxymetry before and after the 6MWT were assessed on the first visit. BODE index was calculated for classification of COPD using body mass index (BMI), post-bronchodilator FEV1 (% predicted), grade of dyspnoea (measured by the modified Medical Research Council dyspnoea scale - mMRC) and the 6MWT distance,[13] and patients were classified into severity stages: BODE 1 (score 0–2), BODE 2 (score 3–4), BODE 3 (score 5–6) and BODE 4 (score 7–10).[16]

Health status questionnaires

The COPD Assessment Test (CAT)[9] was applied to all subjects during the first and last visit to the rehabilitation training program. CAT has 8 items and raises questions about symptoms, energy, sleep and activity. CAT was classified into 4 classes: slight impact (score 0–10); medium impact (score 11–20), high impact (score 21–30) and very high impact (score > 30).

Statistical analysis

The statistical analysis was performed using SPSS for Windows version 19 (SPSS Inc., USA). Continuous variables are presented as mean ± standard deviation (SD) and categorical variables as absolute number and/or percentage. Spearman's rank correlation test was performed to measure how closely the COPD assessed by CAT questionnaire agreed with the one assessed by the BODE index. *T*-test was used to compare means between CAT impact groups of patients (age and BMI). A 2-sided value of $p < 0.05$ was considered as statistically significant.

Results

A total of 50 patients were included (the baseline characteristics of these patients are shown in Table 1): 48 males (96%) and 2 females (4%), with a mean age of 62.5±9.5 years. The average BMI was 25.8 kg/m^2 (±4.8 kg/m^2). Considering pulmonary function, FEV1% predicted was 57.1 ± 19.6%, FEV1/FVC 53.2 ± 0.1%, DLCO 59.8 ± 19.9% and in the 6-min walk test, 8 of the 50 patients had significant desaturation (>4%) with a mean distance of 443.3 ± 61.6 m. Arterial blood gas analysis showed paO_2 73.1 ± 9.4 mmHg and $paCO_2$ 39.7±5.0 mmHg.

Table 2 Distribution of patiens according to GOLD spirometric stage, mMRC, BODE index scale and CAT.

Variable	*N*	%
GOLD		
I	7	14
II	25	50
III	14	28
IV	4	8
mMRC		
0	7	14
1	7	14
2	23	46
3	8	16
4	5	10
BODE score		
0	4	8
1	10	20
2	11	22
3	7	14
4	10	20
5	4	8
6	2	4
7	2	4
8	0	0
9	0	0
10	0	0
BODE class		
1	25	50
2	17	34
3	6	12
4	2	4
CAT impact		
Low	26	52
Medium	16	32
High	8	16
Very high	0	0

The number of patients in stages I–IV of COPD severity, as defined by GOLD,[2] showed that the majority of patients were GOLD stages II and III – 78% (Table 2). According to the mMRC scale 46% patients were class 2 (Table 2), with a mean value of 1.9 ± 1.1. Median BODE index of the patients was 2.8 ± 1.8 and 38% were BODE 1–4 (Table 2); considering BODE classes, 25 patients (50%) were class 1 and 17 (34%) class 2 (Table 2). Analysing CAT questionnaire, mean value of the score was 10.7 (±7.4) and about 80% of the patients had slight to medium impact on their quality of life (Table 2).

Looking at patient distribution by age and CAT impact group, younger patients had higher CAT impact and mean age in the low impact group of patients was 62.1 ± 6.2 years; in the high impact group it was 46.3 ± 4.2 years, although this was not a significant difference. Also, in relation to BMI values and CAT impact, we did not find a

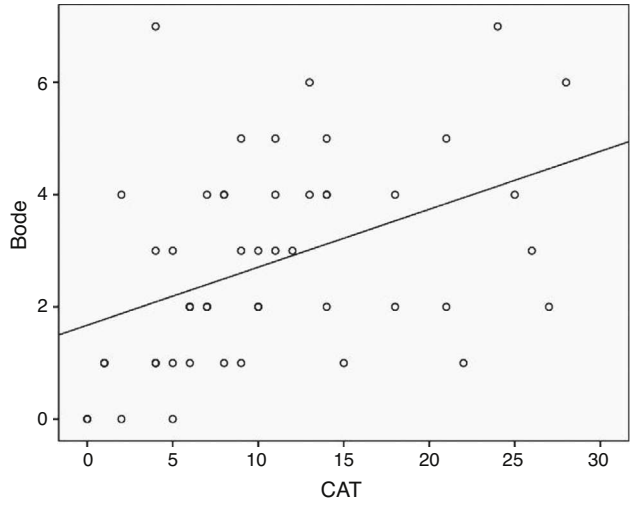

Figure 1 Correlation between CAT score and BODE index score (*R* 0.475, *p* 0.01).

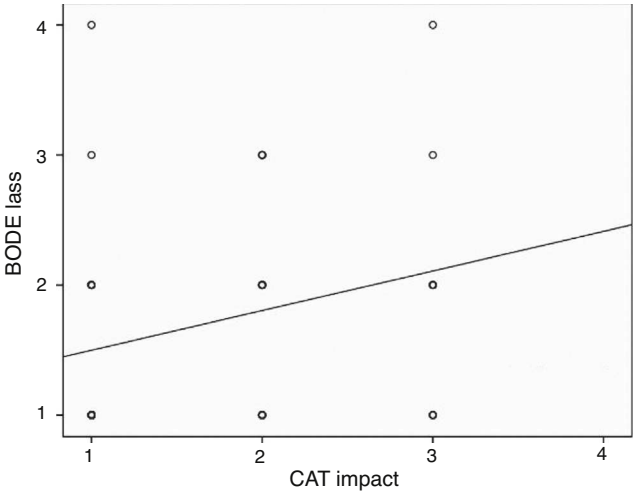

Figure 2 Correlation between CAT impact and BODE index class (*R* 0.315, *p* 0.026).

statistically significant correlation (BMI in the low impact group $23.8 \pm 7.0\,kg/m^2$ and in the high impact group $25.3 \pm 5.1\,kg/m^2$).

We found a positive correlation between CAT and BODE in our patients (96% male), whether considering CAT scores, CAT impact, BODE index score or BODE Index class – CAT score correlated positively with BODE index score (*R* 0.475, $p < 0.01$) – Fig. 1, CAT score correlated positively with BODE index class (*R* 0.357, *p* 0.011), CAT impact correlated positively with BODE index score (*R* 0.377, *p* 0.004) and CAT impact correlated positively with BODE index class (*R* 0.326, *p* 0.021) – Fig. 2.

Discussion

COPD is considered as a part of the ''chronic systemic inflammatory syndrome'' along with the metabolic syndrome, coronary artery disease and others[24] and not only a respiratory disease. The complexity of COPD and its frequent co-morbidities[25] requires assessment and staging of the disease beyond the degree of airflow limitation. Therefore, new GOLD guidelines[4] suggest the assessment of the severity of COPD not only by FEV1 but also by symptom scoring (e.g., mMRC dyspnea scale or CAT score), and the frequency of acute exacerbations of COPD and these conceptual changes reinforce the importance of a good questionnaire in assessing the severity of COPD in clinical practice.

In our data, independently of the spirometric severity of COPD, the majority of patients have low to medium impact of disease using CAT, low mMRC values and good results in 6MWT, which are probably due to their inclusion in a Rehabilitation program. The positive results found in the 6MWT and mMRC also influence the score and class of the BODE index.

Few data are available for discussing the relationship between CAT and BODE and despite the good spirometry, the functional results of our patients and the male predominance, our data did find a correlation between CAT score and impact and BODE index in the evaluation of COPD severity and impact. The correlation between CAT scores and the BODE index, a documented practical instrument in predicting the severity and mortality in COPD population, endorses the use of CAT to characterize COPD patient quality of life.

Some limitations in our study should be addressed. This is a retrospective study in patients at a stable period of their COPD – longitudinal follow-up studies concerning the frequencies of subsequent hospitalization and COPD acute exacerbation and mortality are needed to measure the correlation between CAT and the BODE index better. The number of patients included in this study was quite small, the patients are of the same race and there were only 2 women included. Our data may also have been biased by the single medical-center-based patients: non-hospital patients may have different outcomes.

CAT is a short and valid tool for monitoring COPD health status and the correlation found in this study reinforces the discriminative validity of CAT and its importance as a complement in the evaluation of the true impact of COPD on patients' daily lives. It is important to consider the use of CAT not only in patients assisted in hospitals but also in Primary Care.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed the protocols of their work centre on the publication of patient data and that all the patients included in the study received sufficient information and gave their written informed consent to participate in the study.

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

Authorship

Study design: IL, TG and NT; Data collection: IL, TG, AC and CR; Data analysis and interpretation: IL and TG; Critical revision of the manuscript: AC, CR, MG and NT.

Conflicts of interest

The authors have no conflicts of interest to declare.

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